Excerpts From Project Troy Report to
the Secretary of State, February 1, 1951

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EXCERPTS FROM PROJECT TROY REPORT TO THE SECRETARY OF STATE FEBRUARY 1, 1951

The following are excerpts from or summarizations of portions of the subject report covering the use of radio as an information medium prepared by the Massachusetts Institute of Technology:

MAIN REPORT

FOREWORD

Project Troy was set up by the Massachusetts Institute of Technology as the means for carrying out, under contract with the United States Government, investigations requested by the Department of State.

The organization of the project involved the establishment of a manageable, full time, ad hoc group relieved of other duties so that they could, for three months or so, give their undivided attention to the problems involved.

The group (of panel members) was divided into cross-disciplinary panels to bring in outlines of parts of the problem which ought to be investigated. These outlines were subjected to protracted scrutiny and discussion by the whole group. Specialists were assigned to the parts in accord with the relevance of their knowledge. Care was also taken to include non-specialists in each party. The findings of each party were disclosed to the whole group and the drafts of their contributions were examined, discussed and amended by the whole group. Towards the end an Editorial Committee was established. Their editorial revisions were in turn discussed and amended in plenary sessions.

Although the main report has no identified individual authorship, the annexes have not been subjected to plenary scrutiny and each annex therefore bears the names of members of the sub-group responsible for it.

The initial study requested by the Department of State was directed primarily toward the technical problems confronting the Voice of America in the light of Soviet jamming. "At the outset, however, it was generally agreed that we should also look at other methods of perforating the Iron Curtain, and that the nature of any technical facility was inevitably tied to the target and to the content of the material to be conveyed, and finally to the effect which was ultimately desired."

"As a consequence of this broader study, we have emerged with a concept we call 'political warfare'."

"The importance of our present feeling about 'political warfare' is therefore not a matter of invention, but rather in its emphasis upon that point that comprehension of the whole is what matters most rather than the individual component elements. The newness of our idea, if any, lies in the understanding of the strategic power of the several elements when combined as a well rounded and coordinated whole."

"With respect to political warfare, this report pretends to develop only the fundamental strategic power of the concept, with examples of typical elements such as the Information Program, the defector program, the overload and delay program. No attempt has been made to develop these programs into operational projects." "But in tendering this report, we cannot but repeat once more that the idea which may on the surface appear most naive, the idea that the United States must develop a coordinated political warfare effort is the most important idea in the report. Many people know this must be done. But it will not be done until it is done."

POLITICAL WARFARE

"Invited by the Department of State to try to defeat Russian jamming of the Voice of America, we soon realized that no such isolated study of radio would meet the real issue. The technical problem constitutes only one of a collection of inseparable conditions."

"We have become convinced that the aims of an information program can be fully realized only when the many elements of our national power, political, economic, military, are wielded as an integrated effort. We therefore urge the unification of political warfare."

"Political warfare, we are convinced, should be organized like any other form of warfare, with specialized weapons, strategy, tactics, logistics, and training."

"It is within the framework of this conviction that we have closely examined several of the components of political warfare: e.g., our telecommunications system, information program, a program for defectors, and a program designed to produce overload and delay within the enemy's administrative structure."

"The USSR is using political warfare against us today. The Russians constantly force us to make plans which we have to abandon before they are put into effect. The Russians apply pressure, and, when we move to counter it, they remove the pressure or change its form, so that our efforts may be made to seem ridiculous or hysterical. They attempt to undermine our confidence in our leaders, and to destroy the western alliance."

"In spite of the U.S. beginnings in political warfare such as the Marshall Plan, The Point Four program etc. we are convinced that the United States must go beyond these excellent measures and go over to the offensive in an aggressive, integrated, and comprehensive political warfare program. We may yet achieve our purposes without armed combat."

"With all these things in mind, we present recommendations, specific and general, designed to stimulate the development of an integrated program of political warfare suitable to the demands of the present crisis."

COMMUNICATION INTO SHIELDED AREAS

"A major task of political warfare is to reach our enemy. This section is devoted to the means of communication at our disposal. We were asked specifically to investigate two ways to pierce the Iron Curtain: by radio and by balloon." But there are other means of reaching the people in the shielded areas.

Concern with mechanical devices may tend to conceal the fact that news does travel by itself. One part of the task of the information service is to build up throughout the free world a reservoir of the kind of news about ourselves that we want to have flow through the porous holes in the curtain.

Some specific means of transmitting information through the iron curtain are available, such as direct mail, the professional journal, the industrial and commercial publications, etc. Expansion of the effort to communicate along these normal channels to those behind the curtain is justified even, if initially, it only means the maintenance of communication for communication's sake.

All the other means noticed in these paragraphs are a legitimate part of political warfare. Of less immediate tactical value, perhaps, than radios or balloons, they are nevertheless vitally necessary elements in the political warfare operations of the Information Service.

RADIO

"This chapter deals mainly with the technical problems of radio as a means for perforating the iron curtain. Our recommendations and proposals fall roughly into two classes: first, improvements that can be made now by more or less conventional means; second, fundamental advances requiring considerable preparation, but promising, in the end, very great advantages. Several palliative measures of the first sort are mentioned below and are discussed at greater length in the appropriate Annexes."

Important advances can be made by a) by developing a braadcasting system which combines standard elements so as to achieve the effect of enormous power, and b) by developing a tiny, cheap, self-contained receiver that could eventually be distributed in large numbers over the world. Neither of these ambitious programs can give immediate results, but the way to proceed is clear, as we shall explain below.

"We believe the long-wave band can be profitably used in Eastern Europe, and eventually in other places as well."

"To strengthen our broadcasting position in Europe, the Facilities Branch of the International Broadcasting Division must be assisted by determined and skillful negoiation at the political level, based on a realistic telecommunications policy."

"The jamming of VOA broadcasts, in our view, is only one aspect of a larger struggle - a contest for control of long-distance radio communication in Europe and eventually in other parts of the world too. Our national interest is involved in many ways. The most immediate and obvious threat is to our overseas high-frequency communications. We believe that our vital transatlantic channels can and should be made secure, and propose means for doing so in Annex 22. But this is only the first important defensive action in the electromagnetic war. We must try to seize the initiative -- the high-power transmitter program is a step in that direction -- and we must prepare, by proper organization, to conduct a resourceful campaign of measure and countermeasure. This is part of political warfare."

It is hard to reach radio listeners behind the iron curtain because a) the bulk of the audience is far from our transmitters, b) the listener must have control of a tunable radio receiver, in some privacy, c) he must dare to listen, d) jamming.

From transmitters nearer the boundaries of the target area, and ranged around it, many more listeners could be reached effectively by medium-wave and long-wave broadcasts. Political restrictions limit this, however, both on the availability of sites and on the availability of frequency channels. European allocation of frequencies gives the VOA no elbow room at all in the long-wave and medium-wave bands.

The VOA labors under the technical handicap arising from the practice of originating programs in the United States. These programs must be

transmitted on high-frequency channels to European outlets for rebroadcast. This takes a large proportion of the technical and financial resources of the VOA Facilities Branch. The relays from the United States to Europe are not invulnerable to jamming.

"In spite of these difficulties, the Voice is heard behind the curtain, as is perhaps most convincingly demonstrated by the reaction in the Soviet press and by the jamming. We don't know how many listeners are reached. We do know from recent monitoring reports that the jamming is heavy and effective in Moscow, but not very effective against a determined listener in at least some other places." The reported ineffectiveness of the jamming in rural areas is not necessarily reassuring -- it may mean that in these regions the number of unsupervised high-frequency receivers is too small to matter. The Soviet government broadcasts to its own people by long wave (which VOA does not use), medium wave (with which VOA cannot now effectively reach Russia), and on a very large scale, by loudspeakers wired to radio centrals."

"The Soviet jamming effort is nevertheless formidable. At least several hundred, possibly a thousand, jamming transmitters are in use. Perhaps even more significant is the way they are used. The jamming transmissions appear to be centrally controlled, although the individual transmitters are widely distributed."

"The Soviets rely far more than we do on short-wave radio for internal communication, and they have reached a high state of competence in this field. We thus find the technical forces of the International Broadcasting Division

pitted against an opponent whose resources in equipment and trained persons are most imposing."

"The evidence suggests that the operation is growing in scale and is a direct and major threat to high-frequency radio communication within and to Europe generally."

Measures which can be taken along conventional lines to expand and improve the VOA relays and broadcasts include higher power, highly directive short-wave antennas, improved relay receivers, and, finally, the ambitious expansion of sites and facilities envisaged in the "Ring" plan, which includes a high-power short-wave beam directed from Alaska across the Pole into northern Russia. The transpolar beam, in particular, is more than a merely conventional improvement; it is an ambitious step, boldly conceived, and in our opinion basically sound (see Annex 19).

The Ring plan is a good start, and strong efforts should be made to obtain the sites and frequency channels it calls for.

We emphatically endorse efforts to originate more programs in Europe whether by recordings and teletype script or by actual script preparation in Europe.

"There are strong arguments for expanding the Voice of America operations in the medium-frequency band and for moving into the low-frequency band. Receivers for medium and long waves are cheaper and more numerous than short-wave receivers; a method discussed below for creating a very powerful signal can be used for long waves and perhaps also for medium waves; finally, a strong signal at long or medium waves provides clear, reliable, easy reception."

"To move in this direction, we need more frequency channels and more favorable transmitter sites."

"Until some of the issues are resolved, the only way to strengthen our voice on medium waves in Western Europe and the near Satellite areas is the indirect one of helping other countries to tell our story through their own radio programs. This is being done now, and the effort deserves the strongest support and encouragement because of the psychological advantage of this approach (see Chapter IV)."

"A few very powerful transmitting facilities of our own, suitably located, could send into Russia and the satellites a signal strong enough to compete with jamming."

"When our broadcast signals compete with jamming signals at the antenna of a receiving set, the strongest signal wins." There is no substitute for a strong signal." "If we double our broadcasting power, the jammer has to double his, but no more."

"But the situation is fundamentally changed if we concentrate all our power on part of the target area for a broadcast, then quickly shift the concentration to another part of the target, and so on." "Analysis shows that in this case, as each side strengthens its effort, the jammer has ultimately to increase his investment by the square of the factor by which the broadcaster has increased his."

(The report describes a possible method of accomplishing this.)

The described technique would enable us to send out a signal so strong that a) it cannot easily be jammed over a large area; b) it can be heard

with a receiver as insensitive as a simple crystal set. We shall have taken the initiative by a move that requires the Soviet to make a strenuous technological effort in a new direction in order to counter it. Such effort involves the production of equipment which serves no useful military purpose, which from our point of view would be a welcome diversion of their industrial resources.

A final retaliative measure is always possible: the confiscation of receivers. But this strikes directly against the Soviet people themselves and would mark a major psychological victory for us. If that day comes, we ought to be prepared to supply them with receivers.

One of the biggest barriers we face, not only in Russia, but in many other parts of the world, is the scarcity of radio receivers that can hear our broadcasts. "We recommend a concerted effort to develop crystal and transistor receivers for mass production. A good 'cover' as well as a sponsor for this operation may perhaps be found in the Civilian Defense Program, since there is good reason to believe that domestic distribution of receivers not dependent on electric power may be an important step in the preparation of defense against military attack."

"Incidentally, the crystal receiver in conjunction with high-power transmitter can play a useful role in the development of backward areas; it makes possible widespread communication in advance of electrification."

"We have examined a number of novel proposals with sufficient care to be able to dismiss most of them from further consideration."

Broadcasting from airplanes over Russia in the event of war, sudden internal rupture, or other emergency may be useful (Annex 26).

We do not believe that jamming of Russian high-frequency communications is a tactic to be recommended. Such communications are not believed to be highly vulnerable. "A somewhat more attractive proposal is the insertion into transmissions over the Russian point-to-point net of capsuled bits of propaganda which would thus be sure to reach the ears of some listener. This would have to be a rather carefully and neatly planned "grey" or black operation.

The Russian jamming operation seems to us to have clear and serious implications extending beyond the immediate problems of the Voice of America. Soviet radio maneuvers in the last few years strongly suggest a calculated, determined attempt to take control of the ether over Europe. Indeed, the jamming of the Voice of America may be only an opening skirmish in a long struggle which we have called the electromagnetic war. "In another direction the Soviets have been systematically 'cornering' frequency allocations in the short-wave spectrum, by quasi-legal methods, and are establishing a position as the real frequency-controlling authority on the Eurasian continent."

"Aggressive moves by us will, of course, intensify the struggle. But if we do not recognize and accept the challenge, the free world may find itself without long-distance communications lines."

We see serious weakness in our present national position. "We have no central authority, no 'general staff', to direct a long campaign involving all of our external lines of communication, governmental, private, and military. Technical intelligence, absolutely essential for conducting such a war, has to be organized for the job." "If our high-frequency transmissions

were jammed (they could be jammed tomorrow) and the Atlantic cables cut by submarine action, air mail would be our only means of communication with Europe."

"While we make no specific recommendations on organizational steps at this time, the problem must be faced, as a matter of national security, now."

"We believe it is now technically feasible to make our transatlantic communication channels secure against possible jamming and to provide, while so doing, much better facilities for communication to Europe than we now have."

"We believe it is in the national interest to undertake without delay the improvement of our transatlantic communication channels. We have explored this problem with some of the agencies that might be involved and have met on all sides ready recognition of its urgency."

"The technical intelligence on jamming and on related Soviet radio operations is recognized by all concerned, and especially by those most directly involved in its collection and evaluation, to be sadly inadequate."

SUMMARY OF MAIN CONCLUSIONS AND RECOMMENDATIONS

A) The long- and medium-wave bands offer the best opportunity for strengthening our broadcasts and expanding our audience.

B) To combat jamming effectively, standardized high-power transmitting units for long and medium waves should be developed for use in coherent arrays. Engineering studies leading to equipment specifications should be initiated at once.

C) Design of a small crystal receiver suitable for large-scale manufacture and wide distribution should be initiated at once; at the same time,

development of transistor receivers should be started.

d) A wideband transatlantic communication facility, reliable and secure against jamming, can and must be provided. The appropriate agency should at once sponsor a thorough engineering study of the several possible methods.

e) The national telecommunications policy must be reexamined, taking into account Soviet aggression and expansion in the ether, our own long-range plans, and the present welter of conflicting interests in European channels.

f) The challenge of the electromagnetic war is serious and we are not organized to meet it.

BALLOONS

(The report discusses balloons in some detail, both as to possibilities, possible countermeasures, timing, operational feasibility, logistic problems, USSR potentialities for balloon warfare, etc. The recommendations of the report are as follows:)

a. An enhanced balloon project should be carried out especially in view of possible critical situations.

b. The balloon problem is a part of political warfare. It cannot be handled by a separate balloon shop. Organizational planning for use of balloons in political warfare, leaflet preparation, stockpiling and site selection must start now. They should be integrated in a general political warfare program. Timing and responsibility for final operation must be held in this integrated program.

3. Evaluation of Russian potentialities should be made part of the integrated program.

4. Plans for a full operational-test should be made now. A program to fix standards for production and operating procedures, to locate production facilities and to obtain enough production for such a test should be started now.

5. Development work should be continued on basic technical aspects of operational feasibility: gas bags, flight equipment, meteorological background and trajectory forecasting, and especially gas supply.

ANNEX 19: IONOSPHERIC MATTERS

(This Annex is a semi-technical discussion of radio propagation phenomena, particularly with reference to how the penetration by the VOA may be improved from the standpoint of the physics of radiowave propagation.)

The report concludes with the following, "Based on this general account, which is well known, but not often discussed in print, it is possible to make certain suggestions with regard to Voice of America operation:

(a) The extensive and ever-increasing use of Tangier as a relay point is excellent. The development of alternative high-frequency relay points somewhat further south should be considered, as well as the exploration of other possibilities for communication or program transmission to Europe (see Annex 22 on transoceanic relays).

(b) The possibilities of high-frequency broadcasts beamed to northern Europe and in particular to the northern part of the U.S.S.R., both European and Asiatic from northeastern Alaska, should be

given careful consideration (see Fig. 1). The available evidence is that they would be moderately successful and probably worth while. Care should be taken to avoid twice crossing the zone of maximum disturbance even at right angles, and broadcast points from southern Alaska should therefore be avoided. There are other and probably propagation-wise better northern sites to be considered should the suggestion be adopted in principle. [redacted] 25X6

25X6

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ANNEX 20
HIGH POWER BROADCASTING

(This Annex reviews the techniques and state of the art of high-power broadcasting and proposes areas of research and development, and concludes with the following:)

12. Summary of the System Proposed

As the basic unit of a low-frequency coherent array we recommend a one-megawatt transmitter, and an antenna consisting of two vertical towers. Further engineering study is needed to determine whether both towers should be driven, and whether top-loading tricks should be employed. Obviously, there are many other points that will require careful investigation if the most economical and practical design is to be achieved. The basic units should be uniform in design, and emphasis should be put on simplicity, reliability, and ease of installation.

The equipment should be, so far as possible, transportable, and should be patterned after military equipment rather than commercial broadcasting equipment.

"A sketch of one embodiment of these ideas for a 200-kc array is shown in Fig. 10. For this example, the simplest two-tower antenna has been chosen - one driven radiator and one parasitic. The plan view shows the layout of a 10-unit cluster, with a separation between units that is probably more than would actually be required. Allowing for losses in the ground or antenna structures, this cluster should have an effective radiated power of at least 100 megawatts in the main lobe. The width of the main lobe would be about 30° and it could be directed anywhere within a 120° arc. The night sky-wave field strength at 1000 miles would be about 20 millivolts per meter, and about 10 millivolts per meter at 1400 miles. Over good ground, the ground-wave field strength would fall to 20 millivolts per meter at about 500 miles.

"We have not discussed the transmitter-antenna problem for the broadcast band. Suffice it to say that, if propagation measurements show adequate sky-wave phase stability for the application of the coherent-array technique in the medium-frequency band, the design of a one-megawatt unit for that range does not appear to present any unusual engineering problems."

ANNEX 22
BROADBAND TRANSOCEANIC COMMUNICATION

(This Annex reviews the necessity of establishing a broadband transoceanic communication system, particularly across the North Atlantic. It

reviews the various possibilities, including cables, relay systems, ground-wave relay systems, and various types of scattering mechanisms. The report concludes with certain observations and theories which have since led to the development of the so-called "Forward Scatter" technique.)

Abstracted by IPO/F:FHTrimmer:gec
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